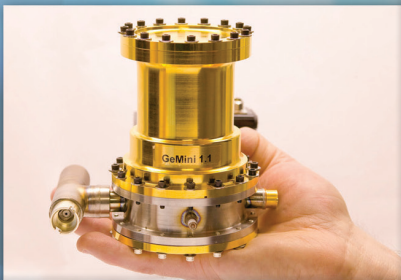


NEXT GENERATION SAFEGUARDS INITIATIVE

ANNUAL REPORT FOR FY2009

Office of Nonproliferation and International Security



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In 2008, the U.S. Department of Energy's National Nuclear Security Administration (NNSA) launched the Next Generation Safeguards Initiative (NGSI), a robust, multi-year program to develop the policies, concepts, technologies, expertise, and international safeguards infrastructure necessary to strengthen and sustain the international safeguards system as it evolves to meet new challenges over the next 25 years. International safeguards are a central pillar of the nuclear nonproliferation regime, and the global community has a major stake in maintaining its effectiveness and credibility. Although NGSI primarily focuses on strengthening U.S. capabilities, the initiative works with the International Atomic Energy Agency (IAEA) and key international partners to keep pace with emerging challenges and provide a foundation for a broader global commitment to international safeguards.

NNSA's Office of Nonproliferation and International Security (NA-24) has primary responsibility for implementing NGSI. The initiative consists of five strategic subprograms: Policy Development and Outreach; Concepts & Approaches; Technology Development; Human Capital Development; and Safeguards Infrastructure Development. In the beginning of FY 2009, NA-24 completed a Five-Year Program Plan (FY 2009-2013) that detailed specific goals, objectives, and projects for each of the initiative's subprograms. This structure was built on existing NNSA safeguards programs to transition the effort into a long-term and coordinated safeguards program.

This annual report highlights international collaboration under NGSI on Next Generation Safeguards as well as NGSI's FY 2009 accomplishments across the five strategic subprograms.

April 5, 2009 President Barack Obama, Remarks in Prague:

"Together we will strengthen the Nuclear Non-Proliferation Treaty as a basis for cooperation...To strengthen the treaty, we should embrace several principles. We need more resources and authority to strengthen international inspections. We need real and immediate consequences for countries caught breaking the rules or trying to leave the treaty without cause. And we should build a new framework for civil nuclear cooperation...so that countries can access peaceful power without increasing the risks of proliferation."



INTERNATIONAL COLLABORATION ON NEXT GENERATION SAFEGUARDS

NGSI seeks to build on existing partnerships by forging closer cooperation between the United States, the IAEA, and other world leaders in safeguards. We recognize that these ties are essential for the international community to meet increasing safeguards challenges. Additionally, through NGSI, the United States will increase its safeguards outreach to countries with credible plans to develop nuclear power.

At the end of FY 2008, NNSA hosted the first annual International Meeting of Next Generation Safeguards, which brought together government officials and technical experts from 11 countries as well as the IAEA to reach a common understanding of the issues to be addressed. At the international meeting, panel presenters outlined current and emerging safeguards challenges. Break-out discussion sections provided participants with the opportunity to share their views on technology, human capital, and safeguards infrastructure needs in a diverse forum. Participants agreed that further consultation and cooperation are essential to support strong and effective IAEA safeguards, and welcomed NGSI for the important role it can play in this regard.

As a follow-on to the 2008 meeting, NGSi sponsored two international workshops in FY 2009. The first workshop, held in Vienna in June 2009, began the process of harmonizing the various types of bilateral safeguards infrastructure assistance provided by the United States, the IAEA, and other states. Workshop participants generally agreed on the importance of safeguards infrastructure assistance and the need for that assistance to be effectively coordinated among various providers. Representatives from seven countries and three international organizations participated in this workshop. A follow-on workshop is scheduled for early FY 2010.

In September 2009, the United States and EURATOM co-hosted an NGSi international workshop on human capital development at the Joint Research Center (JRC) in Ispra, Italy. At this workshop, participants discussed domestic human capital development programs, as well as the resources available for training the next generation of

safeguards professionals. Participants agreed on the need for sharing educational resources and engaging in joint safeguards education programs.

At the July 2009 United States-Russia summit in Moscow, Presidents Obama and Medvedev issued a Joint Statement that called for joint collaboration on international safeguards. In September 2009, a DOE/NGSI safeguards team traveled to Moscow to have preliminary discussions on approaches to international safeguards to make recommendations to the U.S.-Russia Bilateral Presidential Commission Nuclear Energy and Nuclear Security Workshop charged with carrying out this cooperation.

POLICY DEVELOPMENT AND OUTREACH

NGSI has established a Safeguards Policy and Outreach Study Group to support U.S. safeguards policy development and work to strengthen the international safeguards system. In the past year,

this group began several studies on safeguards policy issues, including a series of studies to understand and document the lessons learned about how the IAEA used its legal authorities in cases where undeclared nuclear activities were detected. The group also began an assessment of the IAEA's budget and future resource requirements for safeguards. The results of these studies will help the United States to make recommendations regarding how to strengthen the use of existing IAEA authorities, and the mechanisms through which the United States provides support to the IAEA. The Safeguards Policy Team also began a study of options for increasing the transparency of the IAEA's State Level Approach, a means to improve the effectiveness and efficiency of safeguards by designing,



Experts discuss next generation safeguards issues at the 2008 international meeting.



IAEA Safeguards Analytical Laboratory

implementing, and evaluating safeguards with respect to a state as a whole, not just at specific facilities within the state.

CONCEPTS AND APPROACHES

The goal of the Concepts and Approaches subprogram of NGS is to develop advanced safeguards concepts, approaches, and assessment methodologies to enhance the effectiveness, efficiency and credibility of international safeguards. This year, the U.S. National Laboratories completed studies on a variety of safeguards concepts and approaches including process monitoring, institutionalizing “Safeguards by Design,” safeguards approaches for enrichment and reprocessing plants, proliferation risk reduction assessments of reprocessing technologies, material attractiveness, and the IAEA State Evaluation process. These studies will help to create a path forward for evaluating advanced safeguards approaches.

In FY 2009, the Concepts and Approaches subprogram focused on the development of facility-specific safeguards approaches for gas centrifuge enrichment plants, and

September 14, 2009 Energy Secretary

Steven Chu at the IAEA General Conference:

“Information will be the life blood of a strengthened safeguards system. The IAEA needs our support as it develops an information-driven approach that goes hand-in-hand with the access rights of IAEA inspections to help them uncover clandestine activities. And resources for IAEA safeguards activities must keep pace with demand.”

succeeded in engaging the IAEA and industry in this area. In a related area, NGS also commissioned a new study on the global tracking of uranium hexafluoride (UF₆) cylinders used to transport uranium to and from enrichment plants.

NGS also achieved substantial progress toward the objective of demonstrating and institutionalizing “Safeguards by Design,” the process by which safeguards requirements are incorporated into the design of new nuclear facilities at the earliest possible stage in conceptual design. Effective implementation of Safeguards by Design could help avoid costly and time-consuming retrofits to nuclear facilities and increase both effectiveness and efficiency. In the past year, NNSA has engaged nuclear industry on this issue and initiated a National Laboratory project to draft a technical



NGS is studying possible global tracking of uranium hexafluoride cylinders used to transport uranium to and from enrichment plants.



Nuclear facility construction worldwide offers opportunities to implement “Safeguards by Design.”

April, 2009 U.S. Ambassador to the IAEA Schulte, Remarks on Behalf of Energy Secretary Steven Chu at the IAEA International Ministerial Conference:

"The United States is committed to increasing the capabilities of the IAEA to better carry out all of its vital functions. Key among them is improved international safeguards. The United States has launched a program to build next generation safeguards technologies and a new community of safeguards experts; to assist full use of IAEA inspection authorities; and to foster a culture of safeguards, security and safety in nations using nuclear energy."

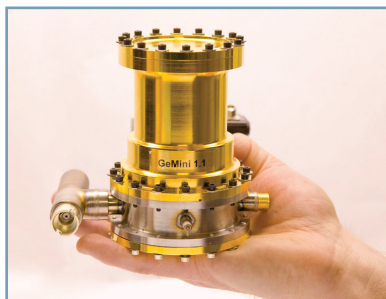
requirements guidance document for international safeguards suitable for use by facility designers.

TECHNOLOGY DEVELOPMENT

The NGSi Safeguards Technology Development subprogram focuses on developing advanced nuclear measurement technology, unattended and remote monitoring systems, data

integration and authentication applications, and field-portable detection tools to help inspectors verify the absence of undeclared nuclear materials and activities.

The centerpiece of this subprogram is a multi-year project to assess 13 non-destructive analysis (NDA) techniques for the direct quantification of plutonium in spent fuel. This effort will help to achieve the NGSi objective of developing advanced tools and methods to detect diversion of declared nuclear materials. Early accomplishments include the completion of a virtual library of spent nuclear fuel assemblies that will be a vital resource for modeling NDA technologies under



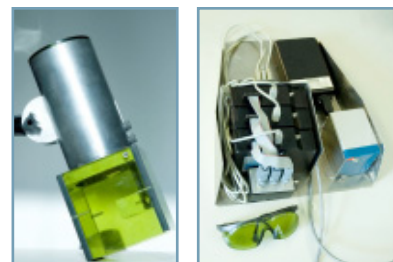
Portable GeMini Instrument

development. NGSi also is pursuing collaborations with foreign partners to validate modeling results with actual test measurements on spent fuel assemblies.

Ten new projects were initiated this past fiscal year related to the objective of developing advanced tools and methods to detect undeclared production or processing of nuclear materials. Program accomplishments include completion of GeMini, a next generation high-purity germanium detector utilizing mechanical cooling that earned a 2009

R&D 100 Award; completion of a prototype portable Laser-Induced Breakdown Spectroscopy (LIBS) system for in-field analysis of inspection samples; and continued development of an advanced flow and enrichment monitor for verifying operations at gas centrifuge enrichment plants.

NGSi also seeks to provide information analysis solutions to improve state level assessments. Current projects include extensive collaboration with foreign partners on unattended monitoring systems and encrypted remote data transmission, both of which could reduce the requirement for on-site inspector presence at particular facilities. Also, on November 3-7, 2008, DOE/NNSA and the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC) co-hosted an international Next Generation Safeguards conference on standardization of safeguards reference codes that will help to increase the consistency of safeguards reporting.



A portable Laser Induced Breakdown Spectroscopy (LIBS) device under development by NGSi.

HUMAN CAPITAL DEVELOPMENT

NGSI is working to revitalize and expand the international safeguards human capital base in the United States by attracting and training a new generation of safeguards professionals. In the summer of 2009, NGSi sponsored five safeguards courses in which U.S. National Laboratory, university, and IAEA experts taught students about the fundamentals of safeguards policy and technology. NGSi sponsored 110 students from more than 40 universities in summer safeguards internships at the U.S. National Laboratories. NGSi also initiated a new program of funding post-doctoral fellows at eight U.S. National Laboratories who will conduct research that supports the NGSi Technology Development and Concepts and Approaches subprograms. The NGSi-funded post-doctoral fellow program will enhance the ability of the U.S. National Laboratories to bring some of the best and the brightest into the international safeguards workforce.

NGSI hosted two University Engagement Workshops in FY 2009, at Oak Ridge National Laboratory and in Santa Fe, New Mexico. These workshops assisted university nuclear engineering faculty with incorporating safeguards and nonproliferation modules into their courses and develop new safeguards-specific courses. NGSi also worked with nine universities to develop safeguards-specific curricula and course work, and NGSi supported visiting expert lectures on safeguards at over twenty universities.



Students learn to measure material held up in process equipment.



NGSI interns learn to use handheld radiation detectors.



NGSI interns participate on safeguards research projects under the mentorship of laboratory technical experts.

In addition to working to recruit and train the next generation of experts, NGSi worked to fulfill its objective of increasing the total number of well-qualified U.S. experts applying for safeguards positions at the IAEA. Brookhaven National Laboratory hosted a workshop on

enhanced recruitment efforts and this subprogram has begun to implement that workshop's recommendations. Also, several National Laboratories hosted mid-career transition workshops to help technical experts transfer into the international safeguards field.

NGSI also launched a human capital requirements study of the U.S. National Laboratory safeguards workforce. This study will provide more comprehensive empirical data on the expected impact of retirements on that workforce, and on specific core capabilities and skill sets needed to support NGSI, as well as potential human capital needs over the next 5-15 years under a range of scenarios that reflect budgetary trajectories and NGSI mission needs. This study, which will be completed in FY 2010, will inform future NGSI Human Capital Development Program investment decisions.

NUCLEAR SAFEGUARDS INFRASTRUCTURE DEVELOPMENT

The NGSI Nuclear Safeguards Infrastructure Development subprogram works to strengthen international safeguards through the development of safeguards infrastructures in countries that have nuclear power or credible plans to develop nuclear power. The specific objectives of this subprogram include assisting states in the development of safeguards administrative authorities and frameworks, increasing states' technical capacities for meeting safeguards obligations, and in the development of sustainable human resources for safeguards.

In FY 2009, the Safeguards Infrastructure Development subprogram organized international training courses in coordination with the IAEA to train international participants in the area of State Systems of Accounting for and Control (SSAC) of nuclear material. Thirty-seven participants representing thirty-three states with nuclear facilities participated in a May-June 2009 SSAC

April 6, 2009 Deputy Secretary of State James Steinberg, Remarks at the Carnegie International Nonproliferation Conference:

"We must improve the verification system. Adherence to the IAEA's protocol must become a duty, not an option. We should explore means of augmenting the IAEA safeguards authorities, and the agencies should receive the increased resources it needs to carry out its rapidly growing responsibilities."



Dr. Jill Cooley of the IAEA leads an exercise during the first international summer seminar in Seattle, Washington.

workshop, and twenty-two participants representing states without nuclear facilities took part in an "International Training Course on SSAC for Countries with Small Quantity Protocols." The United States and Australia also co-organized a workshop in August 2009 on domestic safeguards regulation for representatives of the national authorities in Vietnam and Thailand.

In addition, this subprogram hosted two intensive summer training seminars at U.S. National Laboratories that focused on international safeguards for students from foreign countries planning to establish or expand nuclear power programs. The seminars included policy lectures, nuclear facility tours, technology demonstrations,

and hands-on exercises. The focus was on introducing seminar participants to potential career opportunities and on providing an overview of safeguards concepts and technologies.

The subprogram also developed beta level software with the IAEA that assists countries in preparing their Additional Protocol safeguards declarations. Thailand and Vietnam are participating as beta testers.

Finally, in FY 2009 the subprogram continued strong, bilateral safeguards cooperative relationships with partner countries by concluding older projects – such as “Cooperation on PWR Fresh Fuel Measurements with the Uranium Neutron Coincidence Collar” at the Brazilian Safeguards Laboratory and “Regulatory Development in Safeguards and Security” in Indonesia - and initiating new projects such as “Investigation of Combined Measurements with Three Dimensional Design Information Verification System and Gamma-Ray Imaging Systems for International Safeguards Applications” with ABACC and “Study for Gamma Ray Instrumentation and Analysis Method for Cm/Pu Ratio Measurement in High Gamma Environment” with the Republic of Korea. Other partners also include: Argentina, China, EURATOM, France, and Japan.

Additionally, NGSi held several regional workshops for states with developing interests in civil nuclear power. Each workshop was designed to elaborate on the IAEA

document *Milestones in the Development of National Nuclear Power Infrastructure* published in 2007. In March 2009, NGSi held a “Workshop on Nuclear Energy Preparedness” in Amman, Jordan for participants from Egypt,

Jordan, Kuwait, Oman, Qatar, United Arab Emirates, and Tunisia. Participants discussed issues related to nuclear safeguards, safety, and security. In March-April 2009, the subprogram held a “Workshop on Human Resources for Civilian Nuclear Power: Developing a National Strategy” in Rabat, Morocco. The governments of Jordan, Morocco, Tunisia, Egypt and Algeria sent representatives to this workshop to discuss how to develop a strategy for human resource development for nuclear programs.



An international safeguards infrastructure development workshop.

July 6, 2009 Joint Statement by President Barack Obama of the United States of America and President Dmitry Medvedev of the Russian Federation on Nuclear Cooperation:

“Recognizing the important role of safeguards in promoting confidence in the peaceful use of nuclear energy and in addressing proliferation threats, we will work together to expand opportunities for bilateral and multilateral cooperation to strengthen the overall effectiveness and efficiency of the international safeguards system.”



Middle East Nuclear Infrastructure Preparedness Workshop, April 2009.

PREVIEW OF FY2010 ACTIVITIES

The Second International Meeting on Next Generation Safeguards, co-hosted by Japan, will take place on October 26-28, 2009 in Tokai, Japan. This meeting will build on the progress made at the first meeting and seek to reach consensus among participants on the importance of further international collaboration on Next Generation Safeguards.

With respect to the Policy Development and Outreach subprogram, NGSi studies in FY 2010 will stem from President Obama's landmark speech in Prague last April calling for more authorities and resources for international safeguards. These studies will focus on IAEA legal authority and budgetary issues. They will examine questions related to inspector access to facilities, individuals, and documents to detect undeclared nuclear activities and material; ways to deter unjustified withdrawal from the Nuclear Nonproliferation Treaty (NPT); transparency of the IAEA State Evaluation process and Safeguards Implementation Reports; how and what kinds of information IAEA Member States share with the Secretariat; and current and future IAEA requirements for technology and human resources.

Under the Concepts and Approaches subprogram, NGSi plans to continue to engage the IAEA and industry in the areas of enrichment plant safeguards and Safeguards by Design. With the nascent nuclear renaissance resulting in plans for the construction of new enrichment plants, these two programs will be particularly important to help make international safeguards more effective and efficient, diminish resource burdens on the IAEA and plant operators, and reduce proliferation risks. Other priority projects will include Process Monitoring, Global Tracking of UF₆ Cylinders, Material Attractiveness, and Proliferation Risk Reduction Assessments.

The NGSi Safeguards Technology Development subprogram will continue efforts in FY 2010 to model 13 different NDA techniques for quantifying plutonium in spent fuel with the goal of completing modeling work, joint testing with foreign partners, and down-selecting among the various techniques for development of actual instrumentation. In addition, work on LIBS will continue with the goal of completing a transportable system with higher sensitivity and an in-plant system that could be demonstrated in cooperation with a foreign partner. An updated version of an enrichment monitoring device based on optically stimulated luminescence technology will be completed and tested, and new types of detector materials for safeguards will be identified and evaluated. Finally, a survey of safeguards-relevant reference materials and infrastructure completed in FY 2009 will continue with efforts focused on populating information into a complex-wide database and identification of gaps to be addressed.

In FY 2010, the NGSi Human Capital Development subprogram will continue its summer internship and National Laboratory-based summer safeguards course programs; engage additional university faculty in nuclear engineering and policy programs in developing curricula in international safeguards and nonproliferation; continue the NGSi post-doctoral fellow and professional development programs; and implement, as appropriate, new programs, including a possible graduate fellowship program in international safeguards. The subprogram will complete the human capital requirements study and use the results to "right-size" the subprogram's investments to support projected human capital needs identified in the requirements study.

In FY 2010, the Nuclear Safeguards Infrastructure Development subprogram will continue its bilateral relationships by introducing new projects with existing partners, as well as initiate projects with new partner countries, specifically Armenia and Kazakhstan. The program will also look to expand cooperation in the Middle East and Gulf Cooperation council through both bilateral and multilateral activities.

In FY 2010, NGSi subprograms also will implement actions stemming from the concrete steps to be laid out in the follow-on meeting of the U.S.-Russia Bilateral Presidential Commission Nuclear Energy Nuclear Security Working Group.

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